IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re United States Patent Application of:		)	**Docket No.:**	**4241-198 CON**
Applicants:	**BARETZ, Bruce H. and TISCHLER, Michael A.**	)	**Examiner:**	**Thao X. Le**
Application No.:	**10/623,198**	)	**Art Unit:**	**2814**
Date Filed:	**July 18, 2003**	)	**Conf. No.:**	**2836**
Title:	**SOLID STATE WHITE LIGHT EMITTER AND DISPLAY USING SAME**	)	**Customer No.:**	**23448**

DECLARATION OF BRUCE H. BARETZ UNDER 37 CFR §1.132 IN U.S. PATENT APPLICATION NO. 10/623,198

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

I, BRUCE H. BARETZ, hereby declare:

1. THAT I am a co-inventor with MICHAEL A. TISCHLER of the subject matter disclosed and claimed in United States Patent Application No. 10/623,198 filed July 18, 2003 in the United States Patent and Trademark Office in the names of Bruce H. Baretz and Michael A. Tischler and entitled, "SOLID STATE WHITE LIGHT EMITTER AND DISPLAY USING SAME" (hereafter referred to as the "Application"), which was filed as a continuation of United States Patent Application No. 08/621,937 filed March 26, 1996 in the names of Bruce H. Baretz and Michael A. Tischler for "SOLID STATE WHITE LIGHT EMITTER AND DISPLAY USING SAME," on which U.S. Patent No. 6,600,175 issued on July 29, 2003.

2. THAT the Application discloses and claims the invention of a display including at least one light emission device comprising an LED and a luminophoric medium ("Invention"), and that the Invention has been claimed in independent claim 31 of the Application, as set out below:

31. A display including at least one light emission device, wherein each light emission device comprises an LED energizable to emit radiation with an emission maximum in a spectral range of the blue to ultraviolet spectrum, and a luminophoric medium arranged to be impinged by radiation emitted from the LED and to responsively emit radiation in a range of wavelengths, so that radiation is emitted from the light emission device as a white light output.

3. THAT I am aware that the Application has been examined by the United States Patent and Trademark Office ("USPTO"), that I have read the January 29, 2007 Office Action issued by Examiner Thao Le of the USPTO, and that I am aware that claims of the Application as currently pending have been rejected as being unpatentable, including: a rejection of claim 31 identified above, and claims 32-36, respectively dependent thereunder, as unpatentable under 35 U.S.C. §103(a) over the disclosure of U.S. Patent 3,819,974 (Stevenson et al.) in view of U.S. Patent 5,237,182 (Kitagawa et al.) or U.S. Patent 5,770,887 (Tadamoto et al.); and a rejection of claims 37-38, dependent under claim 31, as unpatentable under 35 U.S.C. §103(a) over the disclosure of U.S. Patent 3,819,974 (Stevenson et al.) and U.S. Patent 5,237,182 (Kitagawa et al.) or U.S. Patent 5,770,887 (Tadamoto et al.), and further in view of U.S. Patent 5,771,039 (Ditzik).

4. THAT I participated together with my legal representative Steven J. Hultquist in a personal interview with Examiner Thao Le at USPTO facilities in Alexandria, Virginia on April 13, 2007 to discuss the Application and the January 29, 2007 Office Action issued by Mr. Le ("Interview").

5. THAT during the Interview I related to Examiner Thao Le facts relating to the making of the claimed Invention by me and my co-inventor Michael A. Tischler, and I affirm and declare such facts, as contained in the following statement of my background, credentials, and the state of the art at the time that the claimed Invention was made by Michael A. Tischler and me:

a. I hold a PhD degree from Columbia University awarded in 1983, where I conducted research in photochemistry and wrote a doctoral dissertation that was substantially focused on luminescence and the excited state properties of molecules constrained to solid surfaces.

b. During the early 1990s, I was retained by Advanced Technology Materials, Inc., of Danbury, Connecticut ("ATMI") as a consultant to work with Dr. Michael A. Tischler of

ATMI, an electrical engineer, on the technology of blue light and uv LEDs and the market opportunity for these light emitters.

c. In the course of this collaborative work with Dr. Tischler, we discussed the commercial potential and appeal of a white light LED as a new product, as opposed to the blue light and uv LEDs on which the general scientific community in the LED field was then focused.

d. At the time of this collaborative work, a primary goal of LED technologists was to develop a sufficiently bright blue LED that when placed in an array alongside green and red LEDs, as a red-green-blue (RGB) LED assembly, would produce a polychromatic white light. Further, the conventional wisdom in the LED field at that time was that such assemblies of red, green and blue LEDs were necessary for LED-based white light production.

c. In these circumstances, Dr. Tischler and I decided that from a commercial perspective, white light and white light backlights, from combination of discrete red, green and blue LEDs, would be less desirable and commercially viable than white light and white light backlights from a single discrete LED. In our collective judgment, the production of a white light backlight required a discrete white light LED, however, none were known at that time, and there was at that time no knowledge or credible evidence that white light could be successfully generated in a single LED assembly with a single LED die.

f. Faced with this situation, Dr. Tischler and I focused on the goal of developing a discrete white light backlight using a discrete white light LED assembly producing polychromatic white light from a single die, addressing ourselves to the technical question of how to generate polychromatic white light in a light emitting diode device, when the LED die itself emitted only monochromatic light of a very narrow wavelength.

g. Dr. Tischler and I then conceived the construction of a light emitting diode assembly in which blue light from a gallium nitride die would singularly excite a fluorescent dye that by design would spontaneously emit fluorescence in the green or red spectrum. In this approach, one could convert a blue LED assembly into a red or green LED assembly, but both Dr. Tischler and I acknowledged that at that time there was no practical benefit since red or green LED assemblies were already well-known and cheap and easy to fabricate, and one would still need blue, green and red LED assemblies to produce white light and white light backlights.

h. Dr. Tischler and I then conceived and considered the ideas of (i) generating polychromatic white light as a combination of red and green emissions plus blue from a single LED die, (ii) generating polychromatic white light as a combination of red, green and blue emissions from a single uv LED die, (iii) generating polychromatic white light by combining several luminophors, and exciting such combined luminophors with an emission from a single blue or uv LED, and (iv) generating polychromatic white light by using a luminophoric medium having several emitting states even if the medium itself did not include distinct molecular species, and exciting such luminophoric medium with a single blue or uv LED, so that the several emitting states of the luminophoric medium simultaneously emitted during the excitation with the single LED.

i. During our conception and consideration of the approaches described in the preceding paragraph, we were not aware of any other efforts in the LED field to generate polychromatic light from multiple emitting states. We also at that time considered reasons why the possibility of several emitting states emitting simultaneously was not prior to that time considered possible. It had been well-known since at least as early as 1973 that energy transfer processes typically involve an exothermic transfer of energy from a donor site molecule to an acceptor site molecule with a substantially lower-energy excited state. We considered why others in the field of light technology would not have attempted to achieve polychromatic white light production through use of multiple emitting states by multiple emitting species in proximity to, or homogeneously dispersed in, one another. We concluded that the absence of such efforts by others resulted from the phenomenon of radiation quenching in excited multicomponent systems. According to this well-known and widely studied phenomenon, energy in the excited multicomponent system is ultimately emitted at the lowest energy excited state, as the energy of the lowest energy quenching species.

j. We therefore considered that the conventional wisdom at that time in the early 1990s would be to avoid mixing multiple luminophoric emitters to generate polychromatic white light since under excitation conditions such multiple luminophoric emitters would not produce polychromatic white light, but would instead produce only light of the spectrum of the lowest energy emitter, by the process of energy transfer from a higher energy luminophoric material to a lower energy luminophoric material, so that the higher energy material relaxes to a ground state without emission, in energizing the next-lower energy material, and such next-lower energy material relaxes to a ground state without emission, in energizing a succeeding next-lower energy material, and so on, until a lowest energy material is energized.

k. The aforementioned quenching phenomenon, in which the ground state of a lower energy emitter quenched the excited state of a higher energy emitter, was at that time in the early 1990s well-known and widely studied, since quenching studies allowed a determination of the excited state lifetime of emitters using very simple equipment. Energy down-conversion from a higher energy excited state emitter to a lower energy emitter, involving quenching of higher energy emitter radiation by a lower energy emitter, was therefore well-known as a thermodynamically favored process not intensity dependent, in contrast to up-conversion involving adsorption of multiple photons by a higher energy emitter from a lower energy emitter using lasers.

l. Against this background of conventional wisdom in the early 1990s that quenching would preclude the production of polychromatic white light from a blue or UV LED exciting a multiple emitter luminophoric medium, Dr. Tischler and I came to the realization that quenching in such luminophoric medium occurs when the rate of quenching is much faster than the radiative lifetime of a higher energy emitter and that if the radiative lifetime of the higher energy emitter were relatively short, in the nanoseconds domain, quenching would be incomplete and multiple emitting states could persist and achieve simultaneous emission with a blue or UV LED excitation source, to produce polychromatic white light. We therefore recognized that polychromatic white light could be produced using a blue or UV LED and a luminophoric medium in which radiative lifetimes of higher energy emitters were sufficiently short so that their excited states were not quenched by and to the lowest energy emitter, and that it was possible to produce polychromatic white light and white light backlights using a single LED die and a luminophoric medium. Thus, the Invention was conceived as a fundamental departure from conventional wisdom in the field of LED technology at that time.

6. THAT I have reviewed and am familiar with the disclosure of U.S. Patent 3,819,974 (Stevenson et al.) and I am aware that such reference has been applied in rejecting claims of the Application, in the January 29, 2007 Office Action identified in paragraph 3 hereof.

7. THAT U.S. Patent 3,819,974 (Stevenson et al.) was asserted by Examiner Thao Le during the Interview on April 13, 2007 to disclose a combination of an LED with phosphor material that inherently produces white light.

8. THAT U.S. Patent 3,819,974 (Stevenson et al.) was issued on June 25, 1974, and contains the following disclosure at column 3, line 24 to column 4, line 7:

"Thus, it is seen that there has been provided and improved light emitting diode capable of emitting light in the violet region of the spectrum. This device may be used as a source of violet light for applications where this spectral range is appropriate. This light may be converted to lower frequencies (lower energy) with good conversion efficiency using organic and inorganic phosphors. Such a conversion is appropriate not only to develop different colors for aesthetic purposes, but also to produce light in a spectral range of greater sensitivity for the human eye. By use of different phosphors, all the primary colors may be developed from this same basic device. An array of such devices may be used for color display systems; for example, a solid state TV screen."

9. THAT the disclosure in U.S. Patent 3,819,974 (Stevenson et al.) quoted in paragraph 8 hereof describes the production of light of specific discrete colors, including the production of violet light, and the production of primary colors; that primary colors are red, green and blue; that there is no disclosure in U.S. Patent 3,819,974 (Stevenson et al.) of generating polychromatic white light; and that there is no disclosure in U.S. Patent 3,819,974 (Stevenson et al.) of any phosphor materials that would produce polychromatic white light in response to violet light emitted by the disclosed light emitting diode.

10. THAT the disclosure of U.S. Patent 3,819,974 (Stevenson et al.) quoted in paragraph 8 hereof, referring to conversion of violet light using phosphors "not only to develop different colors for aesthetic purposes, but also to produce light in a spectral range of greater sensitivity for the human eye" thereby refers to single discrete colors of light and light of a single color, consistent with the state of the art and conventional wisdom that is described in paragraph 5 hereof and applicable to the interpretation of U.S. Patent 3,819,974 (Stevenson et al.) as of the time the Invention was made by Dr. Tischler and me.

11. THAT the disclosure of U.S. Patent 3,819,974 (Stevenson et al.) quoted in paragraph 8 hereof, stating that "all the primary colors may be developed from this same basic device" and thereafter stating that "[A]n array of such devices may be used for color display systems; for example, a solid state TV screen" refers to an array of LED/phosphor devices in which each such device produces one of the primary colors of red, blue and green, consistent with the state of the art and conventional wisdom that is described in paragraph 5 hereof and applicable to the interpretation of U.S. Patent 3,819,974 (Stevenson et al.) as of the time the Invention was made by Dr. Tischler and me.